

Applic. No.: 10/695,367  
Amdt. Dated June 7, 2007  
Reply to Office action of March 23, 2007

REMARKS/ARGUMENTS

) Reconsideration of the application is requested.

Claims 1 and 3-13 remain) in the application. Claims 1 and 8 have been amended. Claim 2 has been cancelled.

In item 1 on page 3 of the above-mentioned Office action, claims 1, 7-8, and 10-11 have been rejected as being anticipated by Xiao et al. (Energy Conversion and Management, January 2002, (43), Pages 103-108; PTOL-892) under 35 U.S.C. § 102(b).

In item 2 on page 3 of the above-mentioned Office action, claims 1, 7-8, and 10-11 have been rejected as being anticipated by Bader (Thesis, Univ. Auckland, February 2002) under 35 U.S.C. § 102(b).

In item 1 on page 4 of the above-mentioned Office action, claims 2 and 5-6 have been rejected as being unpatentable over Xiao et al. under 35 U.S.C. § 103(a).

) In item 2 on page 5 of the above-mentioned Office action, claim 3 has been rejected as being unpatentable over Xiao et

Applic. No.: 10/695,367  
Amdt. Dated June 7, 2007  
Reply to Office action of March 23, 2007

al. in view of Neuschutz et al. (US 2002/0033247) under 35  
U.S.C. § 103(a).

In item 3 on page 5 of the above-mentioned Office action,  
claim 12 has been rejected as being unpatentable over Xiao et  
al. under 35 U.S.C. § 103(a).

In item 4 on pages 5-6 of the above-mentioned Office action,  
claims 2 and 5-6 has been rejected as being unpatentable over  
Bader under 35 U.S.C. § 103(a).

In item 5 on page 6 of the above-mentioned Office action,  
claim 3 has been rejected as being unpatentable over Bader in  
view of Neuschutz et al. under 35 U.S.C. § 103(a).

In item 6 on page 5 of the above-mentioned Office action,  
claim 3 has been rejected as being unpatentable over Xiao et  
al. in view of Neuschutz et al. (US 2002/0033247) under 35  
U.S.C. § 103(a).

The rejections have been noted and claims 1 and 8 have been  
amended in an effort to even more clearly define the invention  
of the instant application. Support for the changes is found  
in original claim 2.

Applic. No.: 10/695,367  
Amdt. Dated June 7, 2007  
Reply to Office action of March 23, 2007

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful.

)  
Claims 1 and 8 recite, inter alia, that the material mixture comprises an amount of a phase change material and an amount of particulate expanded graphite mixed with said phase change material, wherein the expanded graphite is present in an amount of 5 to 40% by volume.

Bader and Xiao et al. each disclose mixtures comprising phase change material and exfoliated /expanded graphite. However, they do not disclose mixtures with a volume fraction of expanded graphite being in the range of 5 to 40 %, as also acknowledged by the Examiner.

With regard to claims 5-6 of the instant application, Bader and Xiao et al. disclose only mixtures containing PCM and the product immediately obtained after thermal expansion of graphite without any further treatment. According to Xiao et al., p.104 § 2.2, the expanded graphite is obtained by thermal expansion/exfoliation of expandable graphite without further treatment. Bader only discloses the mere fact that "exfoliated graphite" was used.

)

Applic. No.: 10/695,367  
Amdt. Dated June 7, 2007  
Reply to Office action of March 23, 2007

In contrast, the expanded graphite used in the present invention is treated further (e.g. compacted and comminuted), resulting in an increased bulk density. These expanded graphite materials are not disclosed by Bader or by Xiao et al.

The Examiner has referred to Tamme (Workshop on Thermal Storage for Trough Power Systems, Feb. 20-21, 2003, Golden CO, page 17) as disclosing the vol% and bulk densities as recited in claims 2 and 5-6. However, it is noted that Tamme has a publication date of Feb. 20-21, 2003, which is later than the priority date of October 28, 2002. Claim of priority and a certified copy of the priority document were submitted on July 29, 2004.

Therefore, claims 2, 5 and 6 have not been validly rejected.

The mixtures disclosed by Xiao et al. contain 80 parts by weight of PCM, 20 parts by weight of SBS and only 3 or 5 parts by weight of expanded graphite. Recalculating this composition into weight percents, the SBS fraction amounts to more than 19 wt% of the mixture. The SBS contributes neither to the heat storage nor to the thermal conductivity. Any addition of other components than PCM reduces the heat storage capacitance. Since there is already a large fraction of SBS,

Applic. No.: 10/695,367  
Amdt. Dated June 7, 2007  
Reply to Office action of March 23, 2007

) only a rather small fraction of expanded graphite can be added, otherwise the heat storage capacitance would decrease too much. It can be easily assessed that the weight fraction of graphite in Xiao et al.'s mixture corresponds to a volume fraction below the lower limit as recited in amended claims 1 and 8 of the instant application. The density of the expanded graphite (without the void fraction arising from porosity, cf. the Xylene density in the Timrex data sheet attached to the Office action) is close to the theoretical density of graphite ( $2.25 \text{ g/cm}^3$ ). The densities of the other components of Xiao et al.'s mixture, paraffin and SBS are around  $1 \text{ g/cm}^3$ , i.e. well below the density of the graphite. When recalculating from weight% into volume%, the value of the graphite fraction, due to its higher density, will be reduced, thus ending up with a value well below 5% by volume. Thus, in the mixture with a composition according to amended claims 1 and 8 of the instant application, the graphite fraction is higher than that in Xiao et al.'s mixtures.

) The mixtures disclosed by Bader contain 55 wt% paraffin, 40% auxiliary polymers (LOPE and EVA) and 5 wt% exfoliated graphite (see table 3.2-1 and note 1 to that table on p.17). The density of paraffin, LOPE and EVA is below  $1 \text{ g/cm}^3$  (see table 3.1-1). Therefore, regarding the assessment of the volume fraction of expanded graphite in Bader's mixture, the same argumentation is valid as discussed above in connection

Applic. No.: 10/695,367  
Amdt. Dated June 7, 2007  
Reply to Office action of March 23, 2007

with Xiao et al., and a weight fraction of 5% expanded graphite corresponds to a volume fraction well below 5%.

) Bader also does not suggest that an increase of the Graphite fraction, which would be beneficial for the thermal conductivity, is possible. The fraction of the latent heat storing paraffin reasonably cannot be reduced because this would result in a reduced heat storage capacitance. On the other hand, the weight fraction of the auxiliary polymers LDPE/EVA cannot be reduced, either, because they are needed to encapsulate the PCM similarly to the function of SBS in Xiao et al.'s composite (see Bader p.8-14).

In contrast, it was found that in the mixtures of the present invention the expanded graphite itself (which is present in a larger volume fraction) effects encapsulation of the PCM (see p.11, 1.14 - p.12, 1.8 of the specification of the instant application), thus avoiding the need to add any auxiliaries which neither contribute to heats storage nor to the thermal conductivity.

It is accordingly believed to be clear that none of the references, whether taken alone or in any combination, either show or suggest the features of claims 1 and 8. Claims 1 and 8 are, therefore, believed to be patentable over the art and since all of the dependent claims are ultimately dependent on claims 1 or 8, they are believed to be patentable as well.

Applic. No.: 10/695,367  
Amdt. Dated June 7, 2007  
Reply to Office action of March 23, 2007

) Applicants acknowledge the Examiner's statement in the section entitled "Allowable Subject Matter" on page 7 of the above-mentioned Office action that claims 4, 9, and 13 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Since claims 1 and 8 are believed to be patentable as discussed above and claims 4, 9 and 13 are dependent on claims 1 and 8, respectively, they are believed to be patentable in dependent form. A rewrite is therefore believed to be unnecessary at this time.

In view of the foregoing, reconsideration and allowance of claims 1 and 3-13 are solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate a telephone call so that, if possible, patentable language can be worked out.

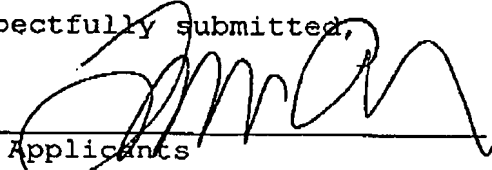
If an extension of time for this paper is required, petition for extension is herewith made. Please charge any fees which

)

Applic. No.: 10/695,367  
Amdt. Dated June 7, 2007  
Reply to Office action of March 23, 2007

) might be due with respect to 37 CFR Sections 1.16 and 1.17 to  
the Deposit Account of Lerner Greenberg Stemer LLP, No. 12-  
1099.

Respectfully submitted,

  
For Applicants

LAURENCE A. GREENBERG  
REG. NO. 29,308

YC

June 7, 2007

Lerner Greenberg Stemer LLP  
Post Office Box 2480  
Hollywood, FL 33022-2480  
Tel: (954) 925-1100  
Fax: (954) 925-1101